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Original Research Article

Impact of Online Anatomy Laboratory Video Supplementation on Students' Performance in Gross Anatomy Assessment

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ABSTRACT

Introduction: There are mixed reports on the effectiveness of online gross anatomy videos on medical students' academic performance. Additionally, there is a paucity of research on the impact of gross practical videos on medical students' performance. Hence, we aimed to study the impact of practical videos supplementation on students' performance in the gross anatomy examination.

Methods: In the present retrospective cross-sectional study, two different cohorts of medical students were exposed to different teaching methods for learning gross anatomy practicals. The two cohorts learned practical gross anatomy face-to-face in the laboratory, but one cohort was supplemented with online video demonstrations. An Independent T-test was used to evaluate the differences in students' objective structured practical exam (OSPE) performances of the two cohorts. The gender differences in OSPE performances were also analysed using the one-way ANOVA test.

Results: The mean score in the OSPE for the 2021 cohort was 17.35±0.2, while the mean score for 2019 was 16.44 ±0.15. The mean score in the OSPE was significantly higher among the cohort that received hybrid practical teaching than the cohort that only received traditional teaching (p= 0.001).

Conclusion: Video supplementation was found to be effective in improving students' performance. In addition to conventional face-to-face teaching, video supplementation for gross anatomy practical sessions may be beneficial for learning gross anatomy.

KEYWORDS: Gross anatomy, practical, traditional teaching, performance, learning.

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INTRODUCTION

The COVID-19 pandemic lockdowns significantly altered the global educational landscape. As a result, traditional face-to-face teaching and hands-on practical sessions shifted to online mode to maintain and support the delivery of medical education. Anatomy is a fundamental subject in the education of health professionals because it deals with structures in the human body. Anatomy is a 3D subject that requires handling and manipulating structures in cadaveric dissection or prosected specimens to appreciate the spatial relationships and interactions

between the organs and structures [1]. The dissection and anatomy demonstrations through hands-on experience were shown to encourage and promote collaborative learning [1]. In a study, Khan *et al*. concluded that 80% of students found that cadaveric study was more effective than studying textbooks and attending lectures [2]. The same study also found that hands-on experience in the practical laboratory enhanced anatomical learning [2].

Plastinated specimens and virtual 3D anatomy models are used in modern medical schools to support gross anatomy teaching and learning and to supplement traditional cadaveric dissection. A study conducted on Jordanian medical students showed that 79.1% used YouTube as an anatomy-learning tool to supplement their knowledge, with 92.9% using it primarily to study gross anatomy [3].

At the College of Medicine and Health Sciences, the MD program, which is six years in duration, is divided into three main phases. Phases I and II combined are three years long and focus on fundamental preclinical knowledge. In contrast, Phase III is also three years in duration and focuses on clinical training through a patient-oriented approach. The anatomy course is taught to the MD program's Phase I and Phase II medical students. During the lockdown imposed by the COVID-19 pandemic, medical students at the College of Medicine and Health Sciences had to rely mainly on in-house developed videos for their gross anatomy practical learning in 2021. To explore the effectiveness of these practical videos, we introduced a hybrid practical delivery method to the year 2021 cohort, wherein online gross anatomy practical videos were provided as supplementary material in addition to the routine face-to-face practical teaching in the lab. Furthermore, there is a paucity of studies on the effectiveness of gross anatomy practical videos on students' performances. This created a new opportunity to study the impact of the different methods of gross anatomy teaching on students' OSPE performances. The current study sought to investigate the effect of practical video supplementation on students' performance in gross anatomy OSPE.

METHODS

Study design: A retrospective study was conducted to evaluate the impact of the hybrid gross anatomy practical teaching method on students' performance.

Study setting and participants: This study was conducted at the College of Medicine and Health Sciences, Sultan Qaboos University, Oman. We included Phase 2 Semester I medical students from two different cohorts; year 2019 and year 2021. There were 144 students in the 2019 cohort and 143 in the 2021 cohort. The students in phase II semester I of the MD program study anatomy gross practical covering head and neck, thorax, abdomen and perineum regions. A practical handout with learning objectives of the whole semester's practical content was usually provided to the students at the beginning of the semester. Students from two cohorts (the year 2019 and the year 2021) were exposed to different gross anatomy practical teaching methods.

Practical videos preparation: High-quality, practical videos were prepared by the same instructors using the models and prosected specimens. All the objectives in the practical handout were covered in the practical videos. The technical staff from the Centre for Educational Technology (CET) department, with all audio-visual aids (Canon 5D Mark III camera), visited the anatomy laboratory to shoot the video. After the preliminary exercise, the practical demonstration by the instructor was shot with the aid of sound mixing apparatus. The instructor used the same models and prosected specimens that are usually used for face-to-face teaching in the laboratory. Each practical session was shot in two to three videos, each of fifteen to twenty minutes in duration. After shooting videos, the instructor and technical staff were involved in the quality check-up of each video using Adobe Premiere Pro software. The instructor relied on the practical handout as a guide to verify the content and to cover all the objectives in the recorded video. Once the instructor was convinced of the quality and content, videos

(mp4 format) of each practical sessions were used for sharing with the students in mp4 format. The videos were prepared for all eleven practical sessions of this course.

Gross anatomy practical teaching: In Phase 2 Semester I, gross anatomy practical was taught in 11 sessions with one hour and fifty minutes for each session. The student and faculty ratio in face-to-face teaching is about 1:20 students. Students from the 2019 cohort were exposed to traditional face-to-face practical teaching methods with hands-on experience with models and prosected specimens. In this teaching method, students (year 2019 cohort) usually spend one hour and fifty minutes in the anatomy labaratory. In the first half of the session, students practised the learning objectives given in the practical handout using models and specimens placed at different stations in the laboratory. In the next half of the session, the instructor taught objectives by utilizing models and prosected specimens.

On the other hand, students from the 2021 cohort were exposed to a hybrid practical delivery method. In this method, the students were taught by the instructor in the anatomy laboratory, similar to face-to-face teaching with hands-on experience with models and prosected specimens. Additionally, they were also supplemented with gross anatomy practical videos that were prepared for online teaching during the COVID-19 pandemic lockdown. These videos were posted on the common teaching platform "Moodle" along with other course content. The students were instructed to use these videos to prepare and revise the practical objectives. The videos were available in Moodle throughout the semester, and there were no downloading restrictions. At the end of the semester, the students' OSPE marks from the two cohorts were analyzed to evaluate the effectiveness of the practical video supplementation on the students' performances in OSPE. The study was conducted following institutional ethics committee approval (REF. NO. SQU-EC/ 649/ 2021).

Statistical analysis: The statistical analysis was performed using the SPSS® software package (v.23) for Windows v24.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (e.g., frequency and percentage) were used to present the data. An Independent T-test was used to evaluate the differences in students' performances in OSPE of two cohorts. The gender differences in OSPE performances were also analyzed using a one-way ANOVA test. A coefficient of variance (CV) was calculated using the formula SD/Mean × 100. A *p*-value <0.05 is considered statistically significant.

RESULTS

The present study compared the students' OSPE performances in the anatomy course of the MD program between two cohorts that were exposed to two different gross anatomy practical teaching methods, and the results are presented in Table 1. The 2021 cohort, which had access to supplementary online material in the form of video supplementation (hybrid teaching), consisted of 143 students. The 2019 cohort that received hands-on teaching with no in-house supplementary course material comprised 144 students. The mean score in the OSPE was significantly higher among the cohort that received practical hybrid delivery (2021 cohort) compared to the cohort that only received traditional teaching (cohort 2019) (P = 0.001). Approximately, 0.91 marks increased the mean score in the OSPE for the 2021 cohort compared to the mean score for the 2019 cohort. A CV was used to determine the variation in the students' scores in OSPE.

Table 1: Students' scores from two different cohorts. OSPE: objective structured practical exam. (*P = 0.001; Independent T-test)

Groups	Participants (n)	Mean score in the OSPE±SEM	Coefficient of variance (CV)
2019 cohort (Without video supplement)	144	16.44 ±0.15	11.19%
2021 cohort (With Video supplement)	143	17.35±0.2*	13.83%

The value of the CV of 2021 cohort students' scores showed higher variability compared to 2019 students' scores. With video supplementation, males' mean score increased from 16.3 to 17.28, with a net increase of 0.98 marks. Females' mean score increased by 1.07 from 16.55 to 17.62. There were no significant gender differences in OSPE performances with video supplementation (Figure 1).

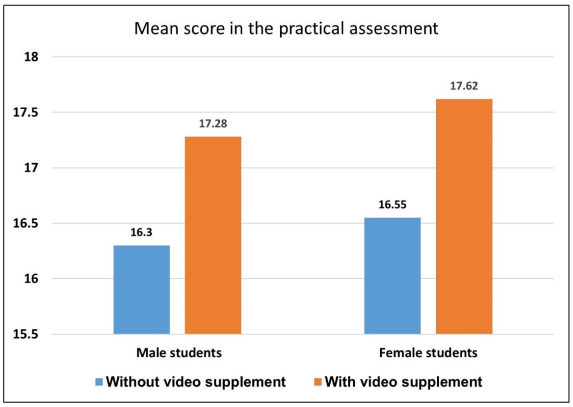

Fig. 1: The gender-wise distribution of objective structured practical exam scores.

DISCUSSION

Anatomy educators and tutors worldwide were challenged to deliver high-class education during the COVID-19 pandemic. The lack of laboratory hours and hands-on teaching, which are the traditional and time-proven methods of teaching human anatomy, were the main obstacles the teaching staff had to overcome to ensure that educational objectives were met and that learning requirements were fulfilled according to the curriculum. As such, tutors at the College of Medicine and Health Sciences at Sultan Qaboos University turned to technology-assisted teaching using high-quality, in-house videos explicitly directed to students at the College of Medicine and Health Sciences while bearing in mind that those videos should stand the test of time to be effectively utilized again in the years to come after the global pandemic of COVID-19 receded.

In terms of academic performance, there are mixed reports on the effectiveness of online gross anatomy videos. Improved performance with the use of anatomy instruction videos has been reported among medical students,[4] osteopathic medical students,[5] chiropractic students,[6] and veterinary anatomy students [7]. However, two studies have shown no effect of videos on examination performance [8,9]. An earlier study concluded that YouTube videos could potentiate good learners' satisfaction [3]. Another study reported that YouTube videos promote student engagement and facilitate their learning capabilities [10]. Online review videos that were prepared to cover course objectives enhanced the instruction of an anatomy course [11]. Online gross anatomy laboratory instruction was shown to be effective and complemented students' learning during the COVID-19 pandemic [1]. A previous research study concluded that online material was beneficial only as additional learning support [12]. A recent study suggested that technology-based digital methods are effective as an alternative to the traditional teaching method for better learning [13].

Technology-assisted teaching and traditional hands-on teaching have proven superior to traditional teaching alone [14-17]. This is reflected in the significant increase in the mean scores in the OSPE when comparing the two cohorts' students. The improved performance of medical students indicates the effectiveness of practical videos in gross anatomy practical teaching and potentiates their implantation for future cohorts.

The beneficial effect of video supplementation is not an isolated incidence in our study. Various studies reported similar benefits when using technology-assisted teaching [18,19]. In a study by Ozer (2017), web-based teaching video packages consisting of a Closed-Circuit Audio-Visual System and Distance Education of applied anatomy were prepared, and their effects on academic performance in anatomy were evaluated [19]. These packages were found to be helpful, definitive, easily accessible, affordable, and suitable for students with different paces in learning. They also increase the learning activity in large group lectures. The study reported an increase of 10 points in academic performance in anatomy [19]. Another study also found a statistically significant improvement of 4% on the final laboratory examination [18]. A recent study results showed that the performances

of online teaching and assessment of both theoretical and practical anatomical knowledge are comparable to face-to-face teaching and assessment [20].

Many other studies found that adding technology-assisted teaching did not significantly improve students' performance but found it helpful regardless [6,21,22]. A study by Meyer et al. (2016) on undergraduate chiropractic students found that neuroanatomy scores were not significantly influenced when students were provided access to technology-enhanced learning resources such as anatomy web-based applications [23]. Specific barriers to improved performance were identified in the same study, such as the "technology learning curve" that students had to overcome three weeks before the summative assessment. Our study differs from the study conducted by Meyer *et al.* (2016) in that our study used educational videos as opposed to anatomy applications [23]. In addition, our study attempted to overcome the "technology learning curve" by providing adequate time for our students to familiarize themselves with the supplementary material before the summative examination at the end of the semester. In-house generated practical videos were aligned with the course objectives. Further, while preparing the videos, the same teaching materials, such as the cadavers and the models, were used for hands-on, face-to-face teaching. The students would have received similar training in face-to-face and online practical teaching methods. In the present study, there were gender differences in students' performances in OSPE of two cohorts, indicating that the motivation and cognitive abilities to use online videos for learning are similar in both genders. To the best of our knowledge, this is the first study to address gender differences in this regard.

Video-sharing websites such as YouTube can synergistically enhance the learning experience of anatomy. A study conducted on 91 second-year medical students revealed that 98% of the students used YouTube as an online information resource at different frequencies, and 92% agreed/strongly agreed that it helped them learn anatomy [11]. However, the quality of the educational videos on such sites is not standardized and thus could be of varying quality. A study investigating the quality of 235 surface anatomy teaching videos on YouTube concluded that 73% were not useful educationally [24]. Similarly, a recent study demonstrated that online anatomy practical demonstration could be a supplementary teaching method for better outcomes [25].

In the current era of information technology, each student enjoys using such learning resources. The most significant advantage of using electronic media for gross anatomy videos is that it can be stored for a long duration, and such presentations are portable. During lockdown, the videos may act as a boon to the students as they can study from their homes. More interactive sessions can be planned by using gross anatomy practical videos in the future. Developing electronic media infrastructure may be relatively inexpensive and could serve as an effective platform for teaching, learning and assessing anatomy. Proper training of both staff and students may be necessary.

Limitations: This is a retrospective observational study. Therefore, well-planned and structured future studies that are tailored to explore the effectiveness of online practical videos are needed. Furthermore, studies need to be conducted to explore the students' perspectives towards the different teaching methods and to what extent they used the supplemented videos.

CONCLUSION

The supplementation of gross anatomy practical videos helped students perform better on the gross anatomy OSPE. Videos of gross anatomy practical sessions may be helpful in addition to traditional live instruction for learning anatomy. Furthermore, the effectiveness of video supplementation observed in the present study would emphasize the importance of teaching practical anatomy online.

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Husain Al Aswami: Data collection and analysis.
Srijit Das: Interpretation and writing the manuscript
Mohamed Al-Mushaiqri: Writing the manuscript
Halima Al Balushi: Conception and design, manuscript writing and final editing.
All authors have read and approved the final version of manuscript.

Conflicts of Interests: None

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